



FAA-E-2474
May 10, 1971

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION SPECIFICATION

COOLING TOWERS FOR EXPANSION AND MODERNIZATION OF AIR ROUTE TRAFFIC CONTROL CENTERS

1. SCOPE

1.1 Scope.- This specification covers the requirements for cooling towers for use at Air Route Traffic Control Centers listed herein.

1.2 Classification.- The capacity of the cooling towers to be furnished for the individual sites shall be not less than indicated in Table I when operating under the conditions noted.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA Specifications and standards of the issues specified in the invitation for bids or request for proposals form a part of this specification.

2.1.1 FAA specification.-

FAA-D-2160a	Instruction Books, Electrical and Mechanical Equipment
-------------	--

2.1.2 FAA standard.-

FAA-STD-013	Quality Control Program Requirement
-------------	-------------------------------------

2.2 Federal publications.- The following Federal publications, of the issues in effect on the date of the invitation to bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Federal specifications.-

FF-B-584	Bolts, Finned Neck; Key Head: Machine; Ribbed Neck; Square Necks; Tee Head
SS-B-775	Building Board, Asbestos-Cement, Flat and Corrugated
QQ-S-741	Steel, Carbon: Structural Shapes; Plates; and Bars
QQ-S-775	Steel Sheets, Carbon, Zinc-Coated
WW-P-406	Pipe Steel (Seamless and Welded) (for Ordinary Use)

2.2.2 Federal standard.-

FED-STD-102	Preservation, Packaging and Packing Levels
-------------	--

2.2.3 Military standard.-

MIL-STD-129	Marking for Shipment and Storage
-------------	----------------------------------

2.3 Other publications.- The following publications, of the issues in effect on the date of invitation to bids or requests for proposals, form a part of this specification and are applicable to the extent specified herein.

2.3.1 American Gear Manufacturers Association standard (AGMA).-

420.03	Helical and Herringbone Gear Speed Reducers
--------	---

2.3.2 American Institute of Steel Construction Publication (AISC).-

Manual of Steel Construction

2.3.3 American Society for Testing and Materials standards (ASTM).-

A 36	Structural Steel
A 386	Zinc Coating (Hot Dip) on Assembled Steel Products
A 569	Hot Rolled Carbon Steel Sheets and Strip, Commercial Quality

2.3.4 American Society of Mechanical Engineers Code.-

PTC-23-1958 Power Test Code for Atmospheric
Cooling Towers

2.3.5 Anti-Friction Bearing Manufacturers Association, Inc.-

Standards for Ball and Roller Bearings and Steel Balls

2.3.6 National Electrical Manufacturers' Association (NEMA) standard.-

MG-1 Motors and Generators

(Copies of this specification and other applicable FAA Specifications may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify materials desired. Requests should cite the invitation for bids, requests for proposals, or the contract involved, or other use to be made of the requested material.)

(Information on obtaining copies of Federal Specifications and Standards may be obtained from General Services Administration offices in Washington, D.C., Denver, Seattle, San Francisco, Kansas City, Mo., Chicago, Atlanta, New York, Boston, Dallas, and Los Angeles.)

(Information on obtaining copies of American Gear Manufacturers' Association standard may be obtained from American Gear Manufacturers Association, Standards Department, 1330 Massachusetts Avenue, N.W., Washington, D.C. 20005.)

(Information on obtaining copies of Military Specifications and Standards may be obtained from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

(Information on obtaining copies of American Institute of Steel Construction publications may be obtained from American Institute of Steel Construction, 101 Park Avenue, New York, New York 10017.)

(Information on obtaining copies of American Society for Testing and Materials Standards may be obtained from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Information on obtaining copies of American Society of Mechanical Engineers publications may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, New York 10017.)

(Information on obtaining copies of National Electrical Manufacturers Association Standards may be obtained from National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.)

(Information on obtaining copies of Anti-Friction Bearing Manufacturers Association Standards may be obtained from Anti-Friction Bearing Manufacturers Association, 60 East 42nd Street, New York, N. Y. 10017.)

3. REQUIREMENTS

3.1 General.- The cooling towers shall be factory-fabricated, mechanical induced draft, vertical discharge, cross-flow, dry basin type. Cooling tower shall be equipped for outdoor service and shall be furnished as a complete unit including finish coatings, special features and accessories as specified herein. The tower shall be manufactured as three complete sub-assemblies suitably prepared for field assembly as a 3-cell tower, except for Oklahoma City where a 2-cell tower is required.

3.1.1 Standard products.- Cooling towers shall be the standard product of a manufacturer regularly engaged in the design and production of packaged cooling towers. Cooling towers shall essentially duplicate cooling towers that have been in satisfactory use at least two years prior to bid opening and shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. All cooling towers of the same capacity shall be completely identical and all component parts for the same end function shall be interchangeable. Maximum practicable use shall be made of interchangeable components, parts, hardware and self-locking fasteners.

3.1.2 Capacity.- Each cooling tower cell shall have the capacity shown in Table I when operating at the conditions and flow rates indicated. Tower manufacturer shall size cooling tower and guarantee performance at altitude indicated in Table I.

3.2 Approval of equipment and materials.- Approval of equipment and materials will be based on compliance with all requirements of the contract.

3.2.1 Materials and equipment.-

3.2.1.1 Materials and equipment.- The following materials and equipment shall conform to the respective specifications and other requirements specified below.

3.2.1.2 Bolting.- Bolting materials shall be hot-dip galvanized steel or bronze, conforming to Federal Specification FF-B-584, type standard with the manufacturer.

3.2.1.3 Steel pipe.- Federal Specification WW-P-406, Weight A.

3.2.1.4 Steel sheets.- Federal Specification QQ-S-775, condition and finish standard with the manufacturer.

3.2.1.5 Structural steel shapes.- Structural angles, channels, plates and bars shall conform to Federal Specification QQ-S-741.

3.2.1.6 Prevention of rust.- All exposed surfaces of ferrous metal not otherwise specified shall be hot-dip galvanized after fabrication in accordance with ASTM Standard A 386 except that coatings shall not weigh less than 2.0 ounces per square foot. Motors, sheaves and associated parts shall have ferrous surfaces primed and painted with machinery enamel in accordance with the manufacturer's standard for outdoor service.

3.2.1.7 Mechanical components.- Mechanical components shall be of commercial quality and shall be identified as to manufacturer and/or part number by casting, stamping, or permanent tag. The cooling tower shall have the manufacturer's name, address, and catalog number on a permanent nameplate securely affixed in a conspicuous place. Couplings, projecting setscrews, keys and other rotating parts shall be fully enclosed or properly guarded.

3.2.1.8 Motors.- Motors shall have class B insulation, totally enclosed type enclosures and shall be rated for continuous duty, 40 degrees C. rise at 40 degrees C. ambient. Motors shall be two speed induction type with single winding, conforming to NEMA Standard MG 1 and shall have NEMA Design B torque characteristics having normal starting torque, low starting current characteristics. The motors shall be 3-phase, 60 Hertz, and 460 volts. The motor horsepower shall be as indicated on Table I.

3.2.1.9 Frame.- The structural frame members shall be of steel hot-dip galvanized after fabrication. The cooling tower shall be designed to withstand a wind load of 30 pounds per square foot on any projected area. Structural frame shall transmit the dead and wind loads to a steel beam frame base which will be fastened to the concrete foundation with anchor bolts. Structural frame shall be designed in accordance with AISC Manual of Steel Construction.

3.2.1.10 Casing and louvers.- Casing shall be 3/8 inch corrugated asbestos cement board conforming to the requirements of Federal Specification SS-B-775, Type A. All joints shall be lapped. Louvers shall be corrugated asbestos cement board of sufficient thickness to prevent sagging and shall be slipfit. All joints shall be water-tight and arranged to shed water inward. Gasketed access panels shall be provided as required for inspection and maintenance and shall be equipped with substantial, corrosion resisting, quick-disconnect fasteners.

3.2.1.11 Distribution basin.- Open gravity type distribution basin constructed of not lighter than 16 gauge, 0.0635 inch in nominal thickness, hot dipped galvanized steel using plastic diffusing type metering orifices shall be provided to assure even water distribution over the entire fill area. Flanged connections for interfacing with field installed piping shall terminate in 125# ANSI drilled full face flanges. Flow control valves for each distribution basin shall be provided. Valves shall be specifically designed for cooling tower service and shall be equipped with locking bar to assure positive setting. Distribution basin covers of 3/8 inch thick asbestos board or hot dipped galvanized steel, not lighter than 16 gauge, shall be provided. Tower structure shall be adequate to support loads imposed by the return water pipe manifolds.

3.2.1.12 Induced draft fans.- There shall be vertical discharge propeller type fans for the cooling tower with one fan located in each cell. Each fan shall have four or six blades constructed of cast aluminum alloy attached to a cast iron or aluminum alloy hub. Each blade shall be individually locked into the hub to resist centrifugal force and shall be adjustable in pitch. Fan assemblies shall be balanced to prevent vibration under normal operating speed and throughout the adjustable pitch range. Fan blade pitch shall be uniform and shall be preset at the factory for the required air flow.

3.2.1.13 Fan drive equipment.- Each cooling tower fan shall have a separate, complete drive assembly. Fan drives shall be through a parallel shaft, helical gear reduction units. Reducer gearing shall conform to AGMA Standard 420.03 with an AGMA service factor of 2.0 minimum. Shaft protrusions through the gear case shall have oil retaining seals. Bearings shall be rolling contact type having a minimum AFBMA B-10 life of 70,000 hours. Motors shall be two speed, 900/1800 RPM nominal speed, direct connected and flange mounted on the gear case. Motor shall not be overloaded throughout the normal operating range of the fan even when operating in denser air prevailing during winter time conditions. The fan cylinder shall be designed with an eased inlet to produce efficient fan operation. Oil fill line with dip stick and drain lines for the gear reducer shall be extended to the tower exterior and to points accessible from the ground or top deck.

3.2.1.14 Vibration shut-down switch.- An adjustable vibration sensing switch shall be installed on each fan base to shut-down the fan at a maximum permissible vibration level. Switches shall be preset at the factory to a setting recommended by the Contractor. Switches shall be single pole, double throw type rated at 5 amperes minimum at 120 volts, 60 Hertz and having a NEMA 4 enclosure. Switches shall be Robertshaw Fulton, Vibration switch, Model No. 366A-WT-115, or an approved equal.

3.2.1.15 Collection basin.- The cold water collection basins shall be minimum 12 gauge steel bottom with 12 gauge steel sides, self cleaning, with depressed center section. Each basin shall be provided with a gravity flow bottom outlet discharge such that tower will operate with a dry basin to prevent cold weather freezing problems during periods of cell shut down. The steel basin shall be fabricated with steel conforming to ASTM A 569 and ASTM A 36. The entire cold water basin assembly shall be hot dipped galvanized after fabrication, minimum zinc coating 2.0 ounces per square foot in accordance with ASTM A 386.

3.2.1.16 Fill and drift eliminators.- Fill shall be lightweight, non-corrosive film type, fire retardant polyvinyl chloride. Galvanized steel fill material is unacceptable. Effective fill volume shall be furnished with submittal for cooling tower evaluation. Drift eliminators shall be constructed of non-corrosive material. Air flow through eliminators shall be two pass designed to limit drift loss as specified.

3.2.1.17 Access and safety.- Access panels shall be provided on both end-walls and for 3-cell installations an access panel shall be provided through the plenum area of one end cell for access to the center cell eliminator and plenum section. A heavy gage, galvanized wire, reinforced grill type fan guard shall be provided over each fan cylinder. One access ladder constructed of galvanized steel located on end of cooling tower shall be provided. The top deck of the cooling tower shall be designed for a minimum live load of 40 psf to support personnel requiring access to all piping and equipment on the top of the tower. As an alternate to this design, a catwalk capable of supporting a similar live loading shall be furnished. The perimeter of the tower shall have a galvanized steel hand rail and toe plate. A safety chain with suitable snap shall be furnished at the top of the ladder.

3.2.1.18 Water outlets.- The cooling tower outlets shall be provided with 125-pound flat face flanges and shall be bottom located so as to discharge into a concrete flume. Bolts and gaskets for piping interface connections external to the towers will not be furnished with the tower.

3.2.1.19 Water inlets.- Each cooling tower water inlet shall be provided with flow control valve. The valve flange diameter and bolt circle shall conform to ANSI class 125 pounds. Bolts and gaskets for the piping interface connections external to the tower will not be furnished with the tower.

3.2.1.20 Tower support.- The cooling tower will be supported on two 12-inch wide flange beams (27 pounds per foot), supplied by others. The tower manufacturer shall provide the anchor bolts and other necessary hardware to attach the cooling tower to the supporting beams.

3.2.1.21 Controls and instrumentation.- Motor starters, switches, wiring and instrumentation will be provided by others.

3.3 Performance.-

3.3.1 General.- Certificates of performance shall cover equipment proposed to meet the performance requirements specified in Table I. In addition guaranteed performance curves shall be submitted for approval which indicate the tower performance at the following conditions. Curves shall be plots of cold water versus design wet bulb. Drift losses shall be less than 0.2 of one percent of water circulated over the tower.

3.3.1.1 Cooling water flow rates at 90%, 100% and 110% of specified rate.

3.3.1.2 Ranges between inlet and outlet water temperatures of 5°F, 10°F and 15°F.

3.3.1.3 Wet bulb temperature at design temperature, 3°F above design and 7°F below design.

3.3.1.4 The combined overall wide-band noise level of the fan, driver and air movement shall not exceed the sound pressure levels of curve NC-70 when measured 5 feet above grade and 50 feet from tower louver face.

3.3.2 Performance tests.- When directed by the Contracting Officer, the Contractor shall perform field tests on the individual cells of the cooling tower in accordance with ASME PTC-23. If the tower fails to meet its requirements the Contractor shall pay for the costs involved in performing the test and shall remedy the faulty design or tower sizing. All costs of redesign, reconstruction, modification, or replacement required to provide a cooling tower conforming to these specifications shall be borne by the Contractor including costs of removal and installation.

3.4 Nameplates and tags.-

3.4.1 Nameplates.- Each cell and fan motor shall have a standard nameplate securely affixed in a conspicuous place, showing the name and address of the manufacturer, serial and model and/or such other information the manufacturer may consider necessary to complete the identification of the item. The nameplate for each cell shall show the load in tons, flow in GPM, design wet bulb temperature, and inlet and outlet water temperature. The nameplate for each motor shall show the horsepower, speed, and electric-current characteristics. All nameplates shall show the FAA Contract Number.

3.4.2 Identification tags.- Each cell unit shall have a tag securely affixed with bolts or screws in an accessible location with the item number used in this specification and the FAA Contract Number etched or embossed thereon. The identification tag shall be of metal not less than 2 inches by 4 inches by 16 gage in thickness. Cells shall be identified with CT-1A, CT-1B, and CT-1C respectively for each site.

3.5 Drawings and other documentation requirements.-

3.5.1 General.- The manufacturer shall submit certified foundation and anchor bolt plans, outline drawings, calculation, certificates of performance, recommended spare parts lists, instruction books, data requirements and other required data for approval in accordance with the requirements specified herein.

3.5.2 Drawings.- Drawings shall demonstrate compliance with the contract documents and shall include, but not be limited to the following:

3.5.2.1 Certified foundation and outline drawings with all pertinent dimensions, connection sizes and locations, and weights.

3.5.2.2 Cross sectional assembly drawings with complete list of materials.

3.5.2.3 Equipment performance curves.

3.5.2.4 Material and equipment lists.

3.5.2.5 Installation drawings.

3.5.2.6 Catalog cuts, brochures, and photographs.

3.5.3 Data requirements.- In addition to all the submittals and information specified elsewhere in this specification, the Contractor shall furnish six copies each of data listed in the attached "Data Requirements List" for each piece of equipment for each site. These data shall be submitted in accordance with the contract schedule. The data shall be delivered to the Contracting Officer and shall be identified as follows:

"FAA Washington, D.C.; Data required to prepare facility operation and maintenance manuals, forward to The Ralph M. Parsons Company."

3.5.4 Certificates of performance.- Each certificate of performance shall be signed by an authorized officer of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applied. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

3.5.5 Recommended spare parts lists.- The Contractor shall furnish a list of spare parts he recommends for an 18-month period subsequent to the expiration of the guarantee period.

3.5.6 Instruction books.- The Contractor shall furnish for each cooling tower unit, an instruction book covering installation, operation and maintenance. The instruction book shall contain but not be limited to all data specified in "Data Requirements" paragraph. The instruction books shall be prepared and submitted in accordance with Specification FAA-D-2160 except as modified herein.

3.5.7 Submittal's identification.- Each drawing or other information submitted for approval shall have, in the lower right hand corner just above the title, a white space 3 inches x 4 inches in which the Contracting Officer can indicate the action taken. Drawings for submittal shall be either blueline or blackline prints on a white background. Blue prints are not acceptable. Each drawing, certificate of compliance, and/or equipment list shall be identified with the following as applicable:

- Contract Number
- Contractor's Name
- Subcontractor's Name
- Supplier's Name
- Manufacturer's Name
- Contract Specifications and Paragraph Number
- Contract Drawing File Number

3.5.8 Number of copies for each submittal.- Submittals of instruction books shall be in five copies and all other submittals shall be in six copies.

3.5.9 Schedule of submittals.- The dates of submittals of the drawings, certificates, recommended spare parts list and instruction books shall be in accordance with the contract schedule.

3.5.10 Approval.- One copy of each document submitted for approval will be returned to the Contractor. If approved, approval of the drawing shall be construed as indicating only that the general method of approach is satisfactory, and shall not relieve the Contractor of his responsibility to provide equipment in full accordance with these specifications, except when a deviation from these specifications has been specifically approved in writing by the Contracting Officer. Approval of instruction books will be in accordance with Specification FAA-D-2160.

3.5.11 Resubmittals.- If a submittal is returned for correction, the Contractor shall resubmit the corrected documents for approval in the same quantity, including reproducibles, as specified for the original submittal.

Late submittals or resubmittals of documents will not constitute an excusable delay.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection.- Each completed cooling tower unit will be inspected at the Contractor's plant by a representative of the Government in accordance with the requirements of FAA-STD-013 Quality Control Program Requirements. The representative will visually inspect the equipment to determine that it meets the physical requirements of the specification.

5. PREPARATION FOR DELIVERY

5.1 General.- The definitions and applications of the various levels of preservation, packaging and packing shall be as specified in FED-STD-102.

5.2 Preservation, packaging and packing.- The preservation, packaging, and packing shall be level C as specified in FED-STD-102.

5.3 Marking.- All unit, intermediate, and shipping containers shall be marked in accordance with MIL-STD-129.

COOLING TOWER

DATA REQUIREMENTS LIST																		
ARTCC _____			Y	ITEM NO.	EQUIPMENT	1	2	3	4	5	6	7	8	9	10	11	12	13
						OUTLINE DRAWINGS & MOUNTING DIMENSIONS	ASSEMBLY DRAWINGS & PARTS LIST	INSTALLATION & OPERATING INSTRUCTIONS	PERIODIC MAINTENANCE SCHEDULE	OVERHAUL & REPAIR PROCEDURES	TROUBLESHOOTING CHART	CALIBRATION & ADJUST. PROCEDURES	WIRING AND/OR FLOW DIAGRAMS	PERFORMANCE CURVES	SPECIAL TOOLS	REQUIRED SPARES	GUARANTEE	OPERATIONAL LIMITS (RPM, TEMP, PRESS, ETC.)
					TOWER	X		X	X		X				X	X	X	X
					VALVES	X	X		X	X						X	X	X
					FANS	X	X		X	X				X	X		X	X
					REDUCTION GEAR	X	X	X	X	X					X	X	X	X
					MOTORS	X	X	X	X	X			X			X	X	X
					SHAFT COUPLINGS		X	X	X	X					X	X	X	X

- NOTES: 1. INFORMATION NEED NOT BE SUPPLIED ON SEPARATE SHEETS
 2. DATA REQUIREMENTS INCLUDE PURCHASED COMPONENTS INCLUDED IN ASSEMBLY

TABLE I
COOLING TOWER DATA SCHEDULE

SITE	ELEVATION FEET	DESIGN WET BULB °F	ZONE WET BULB °F	TOTAL LOAD TONS	TOTAL FLOW GPM
ALBUQUERQUE	5314	66	70	595	1785
ATLANTA	976	78	80	720	2160
BOSTON	250	76	75	680	2040
CHICAGO	614	78	80	830	2490
CLEVELAND	805	76	75	850	2550
DENVER (1)	5332	64	70	1405	1915
FORT WORTH	701	79	80	905	2715
INDIANAPOLIS	793	78	80	715	2145
JACKSONVILLE	10	80	80	745	2235
KANSAS CITY	750	79	80	744	2232
LOS ANGELES	2517	70	70	652	1956
MEMPHIS	282	80	80	745	2235
MIAMI	9	80	80	710	2130
MINNEAPOLIS	859	77	80	715	2145
OAKLAND	18	69	70	602	1806
SALT LAKE CITY (1)	4224	67	70	1405	1915
SEATTLE	451	68	70	607	1821
WASHINGTON	279	78	80	870	2610
OKLAHOMA CITY	1200	78	80	650	1125

NOTE:

(1) All sites have centrifugal chillers except Denver and Salt Lake City

TABLE I
COOLING TOWER DATA SCHEDULE
(CONTINUED)

SITE	EACH CELL		WATER TEMP. °F		FAN MOTOR MAX. H.P.	MAXIMUM HEIGHT TO WATER INLET FEET
	LOAD TONS	(2) FLOW GPM	OUTLET	INLET		
ALBUQUERQUE	298	893	80	90	10	11
ATLANTA	360	1080	85	95	20	12
BOSTON	340	1020	84	94	15	11
CHICAGO	415	1245	85	95	25	12
CLEVELAND	425	1275	84	94	20	12
DENVER (1)	703	958	80	98	15	11
FORT WORTH	453	1358	86	96	25	11
INDIANAPOLIS	358	1073	85	95	20	11
JACKSONVILLE	373	1118	86	96	20	12
KANSAS CITY	372	1116	86	96	20	12
LOS ANGELES	326	978	80	90	15	11
MEMPHIS	373	1118	86	96	20	11
MIAMI	355	1065	86	96	20	11
MINNEAPOLIS	358	1073	86	96	20	11
OAKLAND	301	903	80	90	15	11
SALT LAKE CITY (1)	703	958	80	98	15	11
SEATTLE	304	911	80	90	20	11
WASHINGTON	435	1305	85	95	25	12
OKLAHOMA CITY	325	563	85	99	10	11

NOTE:

- (1) All sites have centrifugal chillers except Denver and Salt Lake City.
- (2) One cell is redundant standby at all sites except Oklahoma City.

